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Improved seat for gate valve

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1 Background of the Invention

This invention is of an improvement to the seat of gate valves used in continuous gas-lift producing oil-wells.

At wells where production is by continuous gas-lift a valve commonly used in working of the well is referred to as a gate valve. It is the valve which lets in gas from between the annulus and the production pipe, into the latter. At a given stage of well discharge production is carried out by means of this gas.

Gate valves consist mainly of a gate which is preset at a given diameter, which does not change as long as the valve is within the well. Flow of gas past this gate is highly irreversible and therefore much load is lost and also it is difficult to calculate rate of flow of gas past the valve, thereby complicating any design or examination.

a 1 Summary of the Invention

This invention is of an improvement to the seat of this kind of valve, with the aid of an optimum geometric arrangement of such seat so as to render flow isoentropic within the valve, thereby greatly reducing the unsuitable effects referred to in the geometry currently adopted. This new idea consists of a so-called compact venturi which is the result of coupling a tapering nozzle to a conical diffuser. This device is almost as efficient as a regular venturi, though quite a lot shorter (a requirement as regards the valve) and much easier to make, therefore cheaper.

Use of this kind of geometry leads to a rise of about 20% in the possible rate of flow of gas through the valve for the same pressure differential between casing and pipe, or, also, a drop of 7% to 20% in casing pressure needed to withstand the same flow of

gas at same pipe pressure (usually the higher of these two figures applies).

A good example of an instance of when the newly-invented valve would be needed is that of satellite wells in deep water where heavy flow and high pressure occur.

Brief Description of the drawings

~~Invention will now be described in greater detail with the aid of the drawings attached hereto, where:~~

Figure 1 is a part section view of a gate valve of the kind in current use, and Figure 1a shows ~~showing~~ an enlarged view of a section of seat;

~~Figure 2 is a sketch of said section of seat;~~

Figure 3 is a view similar of Fig. 2 ~~sketch of such section of seat~~ showing gas flowing through it; and

Figure 4 is an enlarged cross ~~sketch of a~~ section of the improved seat according to the present invention ~~used in the gate valve~~.

~~Figure 1 is a sketch of a gate valve type of gas-lift valve currently in use. In the Figure there is a point marked A where gas enters the valve, passes through the valve seat B (that is, the gate) and leaves out of nose bound C for the inside of the pipe, Figure 1 also shows a detailed view in section of the seat, shown as a sketch in Figure 2, in which the cylindrical body of valve 1 can be seen, the housing 2 for the seat, and the seat 3, the gate 4 and o ring 5.~~

It will be seen that seat 3 is just a disk in which a cylindrical hole of the wanted diameter has been drilled. Edges are, as a rule, sharp but they may also be slightly ~~slinghtly~~ chamfered 6.

Figure 3 is a sketch of flow lines through the gate 4 as through seat 3. Sudden contracting and expanding causes swirls which bring about heavy load losses. Furthermore, the smallest

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area of flow does not take place along the the tight part (seat) but rather, further on, as a phenomenon known as "vena contracta".

Usual kind of modelling consists in supposing an isoentropic flow (reversible adiabatic flow) and then introducing a correction factor (discharge factor), theoretical results being compared with those arrived at experimentally. However, this discharge factor is difficult to express for it depends on several other factors, many of them intangible as regards any theoretical modelling. Hence any designing and study of continuous gas lifting becomes difficult because they depend on proper calculation of gas discharge rates through the valves. Furthermore, the irreversibilities introduce an extra load loss into the system (this is transformed unnecessarily into heat).

In order to diminish the abovementioned drawbacks this invention provides a new kind of geometry for seat 7 as shown in the enlarged sketch of the section at Figure 4.

The improved seat 7 has a curved upper part 8, a straight intermediate vertical part 9, and a straight sloping lower part 10, with central space 11 consisting of a first sloping nozzle kind of part 12, where gas is gradually speeded up; a second cylindrical part 13 diameter of which is the same as that wanted for the gate and which represents main restriction to flow, and a third part 14 in the shape of a conical diffuser, where gas is gradually slowed down. Thus irreversibilities are diminished and the place where flow is least lies at the second part 13, the vena contracta phenomenon being thereby avoided.

Angle α which is responsible for length H1 of the third part 14 is limited by whatever length is available (this being

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more critical in 1 1/2" valves unless modifications are made to the body thereof). Diameter d1 may be the same as d2, but generally, for assembly reasons, is slightly less. Likewise, second part 13 may be reduced, theoretically, to one only part but, also for practical reasons, its length should always be h2 even though small, and h3 should be the length of the first part 12 shaped like a sloping nozzle.

This arrangement is often referred to in literature as a compact venturi, since it is like the ordinary venturi, but quite a lot shorter and easy to make, without however leading to any great differences in performance.

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